Flexible Mode Bridgeless Boost PFC Rectifier with High Efficiency over a Wide Range of Input Voltage

Introduction:

The power supplies with active power factor correction (PFC) feature are required for various types of electronic equipment. Meanwhile, the increasing requirements of high efficiency have been forcing the designers to look for any potential opportunities to reduce the converter losses. The most common solution is the conventional PFC rectifier which is widely used for various kinds of computers, workstations, servers, etc.

However, it suffers from high conduction losses since the input current always flows through two bridge diodes and a power switching device. Besides, the efficiency decrease caused by conduction losses is more obvious when the input line voltage is low, which usually leads to low power density since a large heat sink is needed.

Existing system:

The bridgeless boost PFC rectifiers which can achieve higher efficiency by reducing the number of power components in the line current path. In these boost bridgeless PFC rectifiers, the most
practical and potential topologies are the dual-boost bridgeless PFC rectifier (DBBL PFC) shown and the back-to-back bridgeless PFC rectifier (BTBBL PFC) shown, since both of them have lower common-mode (CM) noise interference and better reliability compared with the others.

Nevertheless, it can be noted that the magnetic core utilization is low for the DBBL PFC rectifier. Although a multiple winding, multicore inductor can be used to improve the utilization of the magnetic material, the efficiency of the rectifier is also reduced, which is not expected. For the above two rectifiers, the high efficiency can be achieved when the input voltage is high.

Dis-advantages:
- Less efficiency.
- More no of components.

Proposed system:

A novel FMBL PFC rectifier is proposed, in which the high efficiency over a wide input range can be achieved. In the proposed rectifier, a BTBBL PFC rectifier is adopted at high-line voltages and a three-level bridgeless boost PFC rectifier (TLBL PFC) is formed to achieve high efficiency at low-line voltages. Compared with the traditional bridgeless boost PFC rectifier, an extra low-voltage bidirectional switch (usually composed of two switches) is added; therefore the increased cost is low.

At both high- and low-line conditions, the Low CM noise can be achieved due to the direct connection between the input power grid and the output electrolytic capacitor during half-line.
cycle. The proposed FMBL PFC can be simply treated as two independent boost PFC circuits according to the line voltage.

**Advantages:**
- High efficiency.
- The increased cost is low.

**Applications:**
- Power factor correction applications.

**Block Diagram:**

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Ac input  ---->  FMBL PFC rectifier  ---->  Load

12VDC  ---->  Gate driver circuit

5VDC  ---->  Buffer circuit

                 ---->  Microcontroller circuit
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